

Cooling the City: Integrating ground-based measurements with modeling scenarios to address urban heat stress among vulnerable populations.

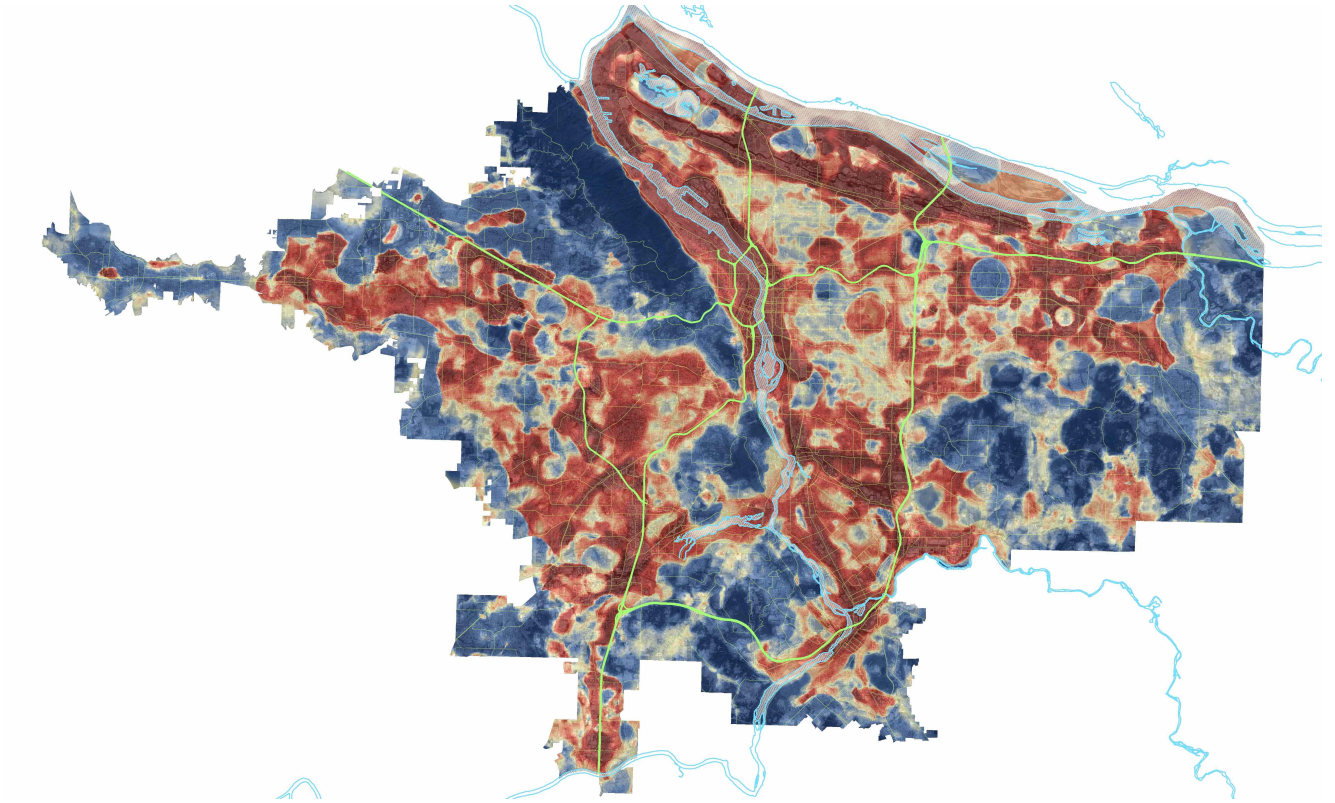
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The mounting evidence about the impacts of climate change on human health presents an urgent need to understand the implication of rising temperatures on the inhabitants of cities, where the majority of people now live. Acute increases in the magnitude, intensity, and duration of extreme weather events has the potential for causing major disruptions in commerce, social process, and human fatalities, especially among vulnerable populations (e.g. older adults, pre-existing health conditions, those with limited coping capacity). One such event is extreme heat, which causes more deaths across the globe per year than all other natural disasters combined. While numerous studies confirm and describe the creation of and processes that mediate urban heat islands (UHIs), few examine the opportunities for mediating microclimate through alternative physical design of the built environment. In this study, we ask two research questions: (1) what built environment characteristics help to explain the presence of UHIs? and (2) to what extent do alternative physical designs help to reduce ambient temperatures in UHIs? We address these questions by assessing the UHIs in the City of Portland, Oregon (USA) through a five stage research process. First, we conducted a series of vehicle-based temperature traverses to identify UHIs where vulnerability populations currently live. Second, we divided the city into 100m grid cells, and conducted a clustering analysis -- normal mixture modeling -- to define the built environment factors that help to explain the presence of UHIs in the study area. The land cover in the grid cells were further divided into seven distinct types of urban morphology. Third, using a computational fluid dynamic (CFD) model, ENVI-met, and a local weather station for calibration, we simulated the spatial distribution of temperature in all of the land cover categories. Fourth, we assessed, the extent to which modifications to the physical designs of the built environment, including land cover characteristics in the select sites would reduce temperatures. Finally, using the seven distinct types of urban morphology, we applied the promising modifications that provided the greatest reduction in ambient temperatures to rest of the city.

We found that six variables helped to predict over 90% of local variation in urban heat: percent canopy, percent vegetation, biomass density, mean building height, total building volume, building height standard deviation. While the canopy, vegetation, and biomass were negatively associated to heat intensity, and the building variables provided a net increase in local UHIs. We note that the seven types of urban morphologies encompass approximately 62% of the city -- the remaining 38% were a mix of multiple types. By exploring several modifications to the built environment, the ENVI-Met model demonstrated that the average temperature of study site can be decreased from 0.5 to 5.5oC by altering the ratios of green and grey infrastructure. Citywide, Highly promising options include increasing density of housing, while strategically introducing green infrastructure to development sites. In addition, by scaling up specific scenarios to the whole city we describe a patterns of development that can simultaneously reduce temperatures, while supporting the meeting many (although not all) development pressures.

Keywords: Urban Heat , Physical Design of Cities, Micro-climatology, Portland, Oregon (USA)



Discovering Tourism Resources in the Two Fishing Villages of the Ozaki Peninsula in Kamaishi City, Iwate, Japan

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After the Great East Japan Earthquake of 2011, many reconstruction efforts have been developed, and new houses and commercial facilities were built in the tsunami-hit areas. The rebuilding of lives and businesses is being continued in some regions, but the local economy is deteriorating or stagnating in others. The Ozaki Peninsula is one of the peninsulas located at the Sanriku Coast, the large-scale ria coast in Kamaishi City in eastern Japan. Before the disaster, a regular service of excursion boats had commenced and many people visited the peninsula for trekking or sightseeing. However, the excursion boats were abolished, and the number of visitors to the peninsula decreased after the disaster. The Ozaki-Shirahama village consisting of around 130 households and the Sasu village consisting of 23 households on the peninsula have the same challenges and problems, and local residents are trying to find a way to revitalize the villages. For the past three years, the Ozaki Hyakunen Gakusya (Ozaki 100-year-old School) has been supporting the efforts of the local people and conducting walking events using nature trails. These events have been regarded by the people as a way to revitalize the villages since some of them participated in the events.

This study aims to support the revitalization of the villages, and twin objectives were set up. One is to discover tourism resources in the two fishing villages, and the other is to propose a new method to bring back visitors and help the area recover from the earthquake and tsunami disaster.

Door-to-door visits and interviews were employed to collect information on tourism resources as evaluated by the local people; field surveys were conducted in 2015 and 2016. Major subject matters of the interviews included: (1) use of the trail and regional resources in the past, (2) change in their lifestyle and livelihood, (3) history and folklore of past disasters, (4) things to pass down to the next generation, and (5) relationship with the other village. A tea ceremony and drinking parties were also held for facilitating participation of both females and males, and the contents of the conversations were recorded as memos.

The results indicated that the trail on the peninsula was used in school excursions, manganese ore mining, religious festivals, and that it was closely related to the lifestyle and livelihood of the local people. At the time of the disaster, all of them survived miraculously and fishery households provided victims with marine products as emergency supplies. Traditional customs such as boat festivals, the Kagura Dance, mutual support, and so on were expected to be passed down to future generations. The relationship between the two villages has always been competitive, but their individual lifestyles were identified. Through the field surveys, some maps and inventories that show the regional resources and historical issues were created. They are thought to be useful in discussing the possibility for expansion into the tourism industry.

Keywords: The Great East Japan Earthquake, tsunami, fishing village, trail, reconstruction



Natural hazard impacts on transportation system in Russia

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The transportation system of the Russian Federation is one of the most extensive in the world. The safety of the transportation is among of the main goals of the national Transport Strategy of the country. In our study we investigate impacts of natural hazards on road and railway transportation. The road and railway infrastructure is exposed to impacts of various natural hazards and adverse weather conditions. The most dangerous of them are heavy rains, snowfalls, snowdrifts, floods, earthquakes, volcanic eruptions, landslides, snow avalanches, debris flows, rock falls, fog or icing roads, and some other natural factors that can trigger many accidents with victims and injuries. Using the data base of technological accidents that was created at the Faculty of Geography of the Lomonosov Moscow State University as well as statistics of the daily number of road accidents provided by the Russian traffic police and meteorological data, we analyze temporal variations and regional differences of the transport accidents' risk within the Russian federal regions and a contribution of various natural factors to occurrences of transport accidents.

The estimate of the weather impact on the car accidents number in Moscow is presented. Various weather phenomena and meteorological parameters that affect the increase and decrease in the number of car accidents in warm and cold seasons were identified; the extent of this influence was assessed. The weather conditions on the days with serious car accidents for 22 years period were considered. The daily numbers of accidents were compared with the weather conditions on the same days. During the cold season, there are much more weather events influencing the growth in the number of accidents than in the warm season. The snowfall intensity of more than 2 cm per day, the reduction in meteorological visibility, drizzle and snow storms lead to an increase of accident rate by 5–15%. The increase in the number of accidents happens in hot weather (maximum of air temperatures over +30 °C) during the warm season.

The 51% of the serious road accidents occur on the days with weak precipitation (less than 5 mm per day), 33% on the days with snow. The slippery road cover can be the reason of about third part of serious accidents: 30% of them occur on the days with transitions of air temperature through 0 °C, 28% on the days with glaze. The 82% of serious road accidents occur in the presence of complicated weather conditions during the cold season. During the warm period, about 50% of serious road accidents occur in the days with rain (27% of accidents on the days when it's intensity are less than 5 mm per day, and 23% - when more). The other weather factors are not significant. The 62% of serious road accidents occur in the presence of complicated weather conditions during the warm season.

More than 4.5% of all railway accidents recorded in the data base are triggered by different natural hazards or adverse weather conditions. During the study period of 1992-2015, railway accidents or violations of rail traffic under the influence of natural factors were recorded in 19 federal regions of Russia. Among of their triggers should be mentioned as follows: snow drifts, washout of railway lines as a result of heavy rains and flash floods, snow avalanches, rails deformation due to heat wave, landslides, debris flows, rockfalls, floods due to spring snowmelt, and some other natural phenomena.

Keywords: transportation safety, natural hazard impacts , adverse weather conditions, road and railway accidents, data base

Intention to Use the National Park and Geopark for Disaster Risk Reduction: A Case Study of Sanriku Tsunami-hit Area

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Recovery is ongoing and the devastated scenery is gradually being improved in the tsunami-hit areas in the six-year period since the Great East Japan Earthquake and Tsunami of 2011. However, massive seawalls have been constructed along the coast for future tsunami disaster prevention, and it is feared that the beautiful natural scenery will disappear from the coastline of Japan. On the other hand, a new concept called “ecosystem-based disaster risk reduction (Eco-DRR)” is emerging internationally in recent years, and it seeks to reduce disaster risks by harnessing the disaster preventing/mitigating functions of ecosystems. In this, the Sanriku Reconstruction National Park (SRNP) has great potential in pioneering the practice of Eco-DRR in Japan. It is expected that the ecosystem of the area designated as a national park can mitigate the damage caused by natural disasters and also have a positive economic impact on the tsunami-hit areas. However, it might be difficult to understand the roles of ecosystems in disaster mitigation, as the concept might have been shared only within the expert community of researchers and administrative organizations. Hence, this study aims to: 1) share the knowledge and thoughts of local people in a meeting for discussing issues such as the roles of the SRNP and the method to assess the attractiveness of the area and 2) understand the prevailing awareness of Eco-DRR.

In order to understand the awareness of residents in a tsunami-hit area, a workshop on the roles played by the national park and geopark in disaster risk reduction (DRR) was held for the local residents, people involved in the tourism industry, government employees, and university students at Jyodogahama, located in the middle of the Sanriku seashore which is one of the best tourist sites in the national park. In this workshop, 26 participants were divided into three groups for discussion, and the contents of the discussions were recorded by cameras and IC recorders. In addition, one of the authors presided at the meeting and assigned one student to each group as a facilitator to ensure smooth progress of the discussion. Four points about the area were discussed: 1) its attraction and uniqueness; 2) the challenges and problems; 3) the roles played by the national park and geopark in DRR; 4) the way to convey its histories, attraction, and uniqueness. After the workshop, the contents were analyzed from the viewpoint of the speaker's attributes and the utterance order.

Some issues such as passing down of disaster histories, information provision, evacuation preparation, and raising of awareness for disaster prevention were thought to be key topics because they appeared repeatedly. On the other hand, few opinions and proposals regarding DRR mentioning the functions of natural environments such as disaster preventing forests and evacuation sites on hills were recorded. It implies that the local people had a shallow understanding of the roles of the ecosystem. Besides, marine products, natural scenery, and the unique landform were thought to be attractive as community resources for tourism promotion. Disaster issues were also thought of as important information to protect people who do not know the risks of tsunamis, and disaster education using this area for children and in-landers was regarded as necessary. From the viewpoint of the awareness of the local people, the relationship between nature conservation and DRR was not clearly found, but the importance of the natural environment and landform was perceived.

Keywords: Sanriku Reconstruction National Park, ecosystem-based disaster risk reduction, workshop



Ecosystem service and the economical effect in the Sake brewery on the coastal sand system in Chiba Prefecture, Japan.

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1. Introduction

The coastal sand system is a buffer zone between the sea and the land, and a fresh water layer is 10 m underground before and after. Water from the fresh water layer has been used as the preparation water of sake breweries on the coastal sand system, and plays a role as an ecosystem service. The number of sake breweries on the coastal sand system in Chiba Prefecture, Japan was 59 in 1925, and was about six times compared to 2016. Moreover, in the Taisho era, the infrastructure did not advance, and the transportation did not develop. Therefore, the regional persons drank sake which was made in neighboring breweries. I presumed that sake breweries made sake utilizing rich natural coastal environments and were prosperous. However, there are no cases studied about the economic efficiency of the sake breweries. In this study, I examined about the economical efficiency of sake breweries that conducted brewing utilizing rich coastal nature.

2. The calculation methods

I translated the sales figures of sake breweries in 1921 into sales figures in 2016.

1 yen = 16,186.6667 yen (this price was calculated based on the price of rice)

<http://nenbetu.atukan.com/>

Tax payment = taxable sales × 0.08 (consumption tax) - taxable sales × 0.08 (consumption tax) × 0.7

(Deemed purchase rate: Manufacturing industry)

Taxable sales = Tax payment / 0.024

3. Result and Consideration

As a result, calculated sales figures of sake breweries in 2016 into those of sake breweries that were in Tokyo Bay side in 1921, two breweries made over 500 million yen. In other cases, two breweries made over 300 million yen, and five breweries made over 100 million yen. On the other hand, looking at the top sales (nationwide version) rank (Tokyo commence and industry Co., Ltd) of nationwide sake breweries in 2010, the number of breweries where sales were 100-500 million yen was 246 and accounted for 47% of the whole. The number of breweries where the sales were 500-1000 million yen was 42 and accounted for 8% of the whole. Compared to sales of sake breweries that were run in sturdy sites in 1921, two breweries with sales of 500 million yen or more were included in the top sales of 81 nationwide sake breweries. In conclusion, although there are differences in the background of the times, such as the favorite alcohol of the people in those days being limited to Japanese sake, I presume that the sake brewery conducted brewing utilizing the bounty of rich coastal nature and had an economic effect.

Keywords: Ecosystem Service, Coastal Sand System, Sales Figures, Japanese Sake Brewery, Economic Effect

Dynamics of coastal sand dune system and their drivers in the Ishikari coast, Hokkaido, Japan

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The coastal sand dune system, which has its own ecosystems and landscapes, is known as a green infrastructure with their various ecosystem services. But most of all them were developed for agricultural and residential land-use in Japan. Ishikari coast in which located north part of Japan, Hokkaido, is one of the well preserved natural sandy coast in Japan, and still keeping coastal sand dune system in natural. However, data for elucidating the coastal ecosystem and their multi functions is insufficient, although there are many studies focused on each function of the coast. Therefore, in this research, we focused on whole system of the coastal sand dune system to clarify the dynamics of the coastal sand dune system and the drivers influenced them through a year at Ishikari coast.

The results of coastal dunes topography survey revealed that erosion and sedimentation has repeatedly occurred through a year. The changes of altitudes were 1 m or more, and horizontal positions of shoreline were 40 meters per year. The topographic change of the coastal dunes has occurred noticeable in the non-vegetation zone, i.e. beach area. But there was no periodic change or a common tendency between the sites.

The climate data of the Ishikari coast shows a clear seasonal change that the temperature is low and the strong sea breeze dominates in winter, but warm and calm wind from inland dominates in the summer. Therefore, it is inferred from the EC value of the soil that salt which moves to inland by the wind decreases in the summer season.

There was clear zonation of vegetation in coastal sand dune depend on the distance from shoreline, dune plants were on the seaward of the dunes and inland plants were on the stabilized dune. While inland plants could not grow near shoreline, dune plants were widely distributed on the dunes. But the coverage rate of dune plants was small on stable dunes because of shading by tall inland plants.

The Ishikari coast was found to be typical coastal sand dune system with resilience, which has a zonation structure of vegetation. Although the influence of the seasonal change of the surrounding weather on the vegetation and the behavior of the landform, the temporal wave attack like summer storm has changed shoreline and foredune. However, it was revealed that the amount of change is largely suppressed by the establishment of vegetation.

Keywords: coastal sand dune system , green infrastructure, ecosystem based disaster risk reduction, resilience